We claim:

1. An apparatus for generating pre-whirl of supply air to the inlet of a radial compressor comprising:

a housing for said pre-whirl generating apparatus, said housing being mounted adjacent said inlet of said radial compressor and forming an intake channel for supply air in communication with and leading to said compressor inlet, said intake channel being preferred to be generally perpendicular to the axis of said compressor and said deformable vane is mounted along a wall of said channel so that in its undeflected position, and said vane does not deflect air passing through said channel;

a deformable air deflecting vane positioned in said intake channel, said vane having a leading edge and a trailing edge, said leading edge being fixed in said channel, and said trailing edge being free to be deflected with respect to said channel to deflect air passing through said channel and being preferably reinforced for stiffness, said reinforced trailing edge being particularly an area of increased thickness of said vane along said trailing edge and/or being a crimp along said trailing edge; and

means for selectively deflecting said trailing edge of said vane so that said vane will deflect air passing through said channel to generate a pre-whirl flow in either the positive, neutral, or negative direction at said inlet of said compressor.

2. The apparatus of claim 1 wherein said vane comprises ate least one of the following characteristics:

a) said vane, in its undeflected position, is arranged in line with normal flow through said channel and does not deflect air flowing through said channel;

b) said trailing edge of said vane can be deflected in a first direction to generate said positive pre-whirl flow or in a second direction to generate said negative pre-whirl flow;

c) said means for deflecting said vane is an annular ring within said housing arranged to rotate around said channel in a plane perpendicular to the direction of said air passing through said channel, said ring being in contact with said vane to mechanically deflect said vane either in a positive or negative pre-whirl direction in response to rotation of said ring around said channel, further characterized in that said ring has at least two tabs extending radially inwardly to receive said vane therebetween and to effect deflection of said vane upon rotation of said ring.

3. The apparatus of claim 1 or 2, wherein said means for deflecting said vane is an annular ring within said housing arranged to rotate around said channel in a plane perpendicular to the direction of said air passing through said channel, said ring being in contact with said trailing edge of said vane to mechanically deflect said trailing edge of said vane either in a positive or negative pre-whirl direction in response to rotation of said ring around said channel, wherein preferably at least one of the following characteristics are provided:

a) said vane, in its natural undeflected position, is arranged in line with normal flow through said channel and does not deflect air flowing through said channel, and, in particular, said trailing edge of said vane can be deflected in a first direction to generate said positive pre-whirl flow or in a second direction to generate said negative pre-whirl flow;

b) said ring contacts said trailing edge of said vane at a contact area near the radially outer corner of the trailing edge of said vane, said contact area being received in a generally axially oriented slot in said ring, whereby upon rotation of said ring in a first positive direction around said channel, said vane is deflected to a position that deflects air flowing through the channel into a positive pre-whirl flow at the compressor inlet, and upon rotation of said

ring in a second negative direction around said channel, said vane is deflected to a position that deflects air flowing through the channel into a negative pre-whirl flow at the compressor inlet,

wherein said contact area is preferably a tab extending from the radially outer corner of the trailing edge of said vane, and said tab includes means for contacting said slot in a way that allows control of said trailing edge of said vane to effect deflection of said vane while permitting twisting of said tab in said slot to accommodate deflection of said vane,

and said slot has, in particular, lateral walls for contacting said tabs, wherein said tab, if desired, has at least one generally convex lateral bearing surface for contacting said wall, and wherein, for example, said tab has two lateral bearing surfaces on opposite sides of said tab for contacting opposite lateral walls of said slot and/or said trailing edge has a crimp and said crimp extends through said tab forming said generally convex lateral bearing surface, and wherein said lateral bearing surfaces are generally hemispherical;

c) said means for deflecting said vane includes a pinion gear cooperating with a rack gear on said ring to rotate said ring in either a first rotational direction or a second rotational direction.

4. The apparatus of and of the preceding claims, further comprising fixing means for fixing said leading edges of said vanes in said channel, said fixing means including

tab means on each of said vanes which extend from the radially outer and/or inner corner of the trailing edge of said vane, and

at least one inner and/or outer fixing element, the inner one being preferably attachable to a cowling,

said tab means and at least one of said inner and outer fixing elements being integrally formed, particularly as a laser-cut part and/or a punched part, suitably of sheet metal,

said tab means being preferably connected to at least one of said fixing means via at least one interconnection portion smaller than said tabs,

wherein preferably said outer fixing element comprises fixing recesses for preventing any rotation, said fixing recess being formed, in particular, in a tab of said outer fixing ring, the tab suitably extending in radial inward direction from said outer fixing ring.

5. The apparatus of any of the preceding claims, wherein said leading edge of said vane is circumferentially fixed in said channel and said trailing edge is free to be deflected circumferentially in said channel and wherein said intake has a generally helical groove, further characterized in that said leading edge of said vane is affixed to a vane carrier that is restricted from rotation in said channel but is free to move axially in said channel, and wherein said trailing edge of said vane has a tab extending radially outwardly, said tab being received in said groove, and said means for deflecting said vane is operative to move said vane carrier axially within said housing to cause said tab to move axially within said groove, thereby causing circumferential deflection of said trailing edge of said vane,

wherein at least one of the following characteristics is preferably provided:

a) said vane carrier includes preferably a rack gear and said means for deflecting said vane is a pinion gear mounted on said housing for cooperation with said rack gear on said vane carrier to move said vane carrier axially in said housing;

b) said grooves have axial ends, said vanes are aligned with normal flow through said channel and do not deflect air passing through said channel when said vane carrier is in an axial position to place said tab in a position in said groove intermediate of the axial ends of said groove;

c) axial movement of said vane carrier toward said inlet causes deflection of said vane in a first direction, and axial movement of said vane carrier away from said inlet causes deflection of said vane in a second direction,

wherein deflection in said first direction causes preferably positive pre-whirl flow at said inlet, while deflection in said second direction causes negative pre-whirl flow at said inlet, said intermediate position of said tab in said groove, in which said vanes do not deflect air passing through said channel, being, in particular, closer to the axial end of said groove away from inlet than the end nearest said inlet, said groove being optionally arranged to provide a greater deflection of said trailing edge of said vane when said vane carrier is moved toward said inlet than when the vane carrier is moved away from said inlet.

6. The apparatus of any of the preceding claims, wherein said means for deflecting said vane is an actuating arm positioned outside of said channel adjacent said trailing edge of said vane and extendable into said channel to engage said trailing edge of said vane and to deflect said vane into said channel, thereby positioning said vane to deflect air passing through said channel, wherein at least one of the following characteristics is preferably provided:

a) said actuating arm is a C-shaped actuator received in a C-shaped recess in said housing and is rotatable through said recess to extend into said channel to deflect said vane into said channel; said C-shaped actuator, said C-shaped recess, and said compressor inlet being preferred to be generally circular and are concentric, and being particularly further characterized in that when said actuator is extended into said channel to deflect said vane into said channel, said vane deflects air flowing through said channel to generate a pre-whirl flow at said inlet, and said C-shaped actuator forms a generally circular chamber for said pre-whirl flow adjacent said inlet;

b) the apparatus includes two vanes on opposite sides of said channel, and further includes means for deflecting said each vane, said means being operative to deflect a first vane to generate a pre-whirl flow in a first direction and to deflect a second vane to generate a pre-whirl flow in a second direction,

said actuating arm being preferably a C-shaped actuator received in a C-shaped recess in said housing and is rotatable through said recess to extend into said channel to deflect said vane into said channel, further characterized in that said apparatus includes two vanes on opposite sides of said channel, and said C-shaped actuator is operative to deflect either vane into said channel,

wherein said C-shaped actuator, said C-shaped recess, and said compressor inlet are preferred to be generally circular and are concentric;

and being particularly further characterized in that when said actuator is extended into said channel to deflect said vane into said channel, said vane deflects air flowing through said channel to generate a pre-whirl flow at said inlet, and said C-shaped actuator forms a generally circular chamber for said pre-whirl flow adjacent said inlet;

c) said actuating arm is an arcuate deflecting actuator attached to a swing arm mounted to swing about a pivot to extend said actuator into said channel and deflect said vane into said channel;

d) said vane is a flexible membrane and said actuating arm is a pivotable actuator having a contact point for contacting said membrane and arranged to pivot into said channel in contact with said membrane thereby deflecting said membrane into said channel,

the apparatus being preferably further characterized in that when said pivotable actuator is pivoted into said channel, said contact point contacts said membrane at about its midpoint, and a portion of said membrane on one side of said contact point forms said air deflecting vane, and the

portion of said membrane on the other side of said contact point forms a pre-whirl chamber adjacent said inlet;

e) said trailing edge of said vane has an attachment means to which is attached the leading edge of a lower plate, said actuating arm contacts said trailing edge of said vane adjacent said attachment means, and said trailing edge of said lower plate is arranged for sliding engagement with the wall of said channel, whereby when said actuating arm is moved into said channel to deflect said vane into said channel, the leading edge of said lower plate follows said trailing edge of said vane into said channel, and said trailing edge of said lower plate slides along said wall of said channel,

wherein the apparatus is preferably further characterized in that when said leading edge of said lower plate follows said trailing edge of said vane into said channel, and said trailing edge of said lower plate slides along said wall of said channel, said lower plate forms a pre-whirl chamber adjacent said inlet;

f) the apparatus is further characterized in that a divider wall is provided in said channel upstream of said vane.

7. The apparatus of any of the preceding claims, wherein said inlet is generally circular and said intake channel is eccentric to the center of said inlet, and wherein at least one of the following characteristics is provided:

a) said vane is attached to a wall of said channel farthest from said center of said inlet, and when said vane is in its undeflected position, it does not deflect air passing through said channel, and a pre-whirl flow is generated at said inlet, wherein preferably the pre-whirl flow generated when said vane is in its undeflected position is a negative pre-whirl flow;

b) said vane is attached to a wall of said channel farthest from said center of said inlet, and when said vane is

deflected to an intermediate position, said vane creates an absence of pre-whirl flow at said inlet;

c) said vane is attached to a wall of said channel farthest from said center of said inlet, and when said vane is fully deflected into said channel, said vane creates a positive pre-whirl flow at said inlet.

8. The apparatus of claim 7, wherein said means for deflecting said vane is an actuating arm positioned outside of said channel adjacent said trailing edge of said vane and extendable into said channel to engage said trailing edge of said vane and to deflect said vane into said channel, thereby positioning said vane to deflect air passing through said channel, further characterized in that said actuating arm is a C-shaped actuator received in a C-shaped recess in said housing and is rotatable through said recess to extend into said channel to deflect said vane into said channel.

9. The apparatus of claim 8, wherein said C-shaped actuator, said C-shaped recess, and said compressor inlet are generally circular and are concentric.

10. The apparatus of claim 9, further characterized in that when said actuator is extended into said channel to deflect said vane into said channel, said vane deflects air flowing through said channel to generate a pre-whirl flow at said inlet, and said C-shaped actuator forms a generally circular chamber for said pre-whirl flow adjacent said inlet.